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Declaration

I, Michihiko Matsuba, President of Fukuyama Sangyo Honyaku Center, Ltd., of 16-3, 2-chome, Nogami-cho, Fukuyama, Japan, do solemnly and sincerely declare that I understand well both the Japanese and English languages and that the attached document in English is a full and faithful translation, of the copy of Japanese Unexamined Patent No. Hei-10-32740 laid open on February 3, 1998.

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ELECTRONIC STILL CAMERA

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SPECIFICATION

[TITLE OF THE INVENTION] ELECTRONIC STILL CAMERA

[ABSTRACT]

[Theme] To provide a small-sized thin electronic still camera.

[Solution Means] A lens system and an image pickup device are provided, wherein the lens system and the image pickup device are disposed adjacent to each other so that the optical axis of the lens system and the center of the imaging surface of the image pickup device are deviated from each other and the rear end of the lens system is positioned further rearward than the image pickup device or a substrate that holds the image

pickup device, and a first mechanical means which moves the lens system in the normal line of the lens surface when the camera takes an image and a second mechanical means which moves the image pickup device to the side below the moved lens system horizontally to the imaging area are provided, and the optical axis of the lens system and the center of the imaging surface are matched with each other by the first and second mechanical means.

[WHAT IS CLAIMED IS:]

[Claim 1] An electronic still camera which obtains an image by imaging a subject, wherein the electronic still camera comprises: a lens system; an image pickup device for converting an image of a subject formed via the lens system into electrical signals; and a mechanical means which holds the lens system or the image pickup device, positions the lens system and the imaging device side by side by deviating the optical axis of the lens system and the center of the imaging surface of the image pickup device from each other when the camera does not take an image, and matches the optical axis of the lens system and the center of the imaging surface of the image pickup device with each other when the camera takes an image.

[Claim 2] An electronic still camera which obtains an image by imaging a subject, wherein the electronic still camera

comprises: a lens system; an image pickup device; a first mechanical means which holds the lens system, and positions the lens system so that the rear end of the lens system becomes further rearward than the imaging surface of the image pickup device or a substrate that holds the image pickup device when the camera does not take an image and the direction toward the subject with respect to the imaging surface of the image pickup device is defined as the forward direction, and moves the lens system in the normal line direction with respect to the lens surface when the camera takes an image; and a second mechanical means which holds the image pickup device or the substrate that holds the image pickup device, and when the camera does not take an image, positions the lens system and the image pickup device side by side by deviating the center of the imaging surface of the image pickup device, and when the camera takes an image, matches the optical axis of the lens system with the center of the imaging surface of the image pickup device by sliding horizontally the image pickup device or the substrate that holds the image pickup device to a position where the lens system that has been moved by the first mechanical means forms an image of the subject.

[Claim 3] An electronic still camera which obtains an image by imaging a subject, wherein the electronic still camera

comprises: a lens system; an image pickup device; and a mechanical means which holds the lens system, and positions the lens system so that the rear end of the lens system becomes further rearward than the imaging surface of the image pickup device or a substrate that holds the image pickup device when the camera does not take an image and the direction toward the subject with respect to the imaging surface of the image pickup device is defined as forward, and positions the lens system and the image pickup device side by side by deviating the optical axis of the lens system and the center of the imaging surface of the image pickup device from each other, and when the camera takes an image, moves the lens system forward of the imaging surface of the image pickup device and matches the optical axis of the lens system with the center of the imaging surface of the image pickup device.

[Claim 4] An electronic still camera which obtains an image by imaging a subject, wherein the electronic still camera comprises: a plurality of lens systems having different focal lengths; an image pickup device; a selection means for selecting which of the plurality of lens systems are to be used for taking an image; and a mechanical means which holds the lens system, and positions the lens systems so that the rear ends of the respective lens systems become further rearward

than the imaging surface of the image pickup device or a substrate that holds the image pickup device when the camera does not take an image and the direction toward a subject with respect to the imaging surface of the image pickup device is defined as forward, positions the plurality of lens systems and the image pickup device side by side by deviating the optical axes of the plurality of lens systems and the center of the imaging surface of the image pickup device from each other, and when the camera takes an image, moves a lens system selected by the selection means forward of the imaging surface of the image pickup device and matches the optical axis of the lens system with the center of the imaging surface of the image pickup device.

[Claim 5] An electronic still camera which obtains an image by imaging a subject, wherein the electronic still camera comprises: a lens system; an image pickup device; and a mechanical means which holds the lens system, and positions the lens system so that the side surface of a lens barrel of the lens system becomes further rearward than the image pickup device or a substrate that holds the image pickup device when the camera does not take an image and the direction toward the subject with respect to the imaging surface of the image pickup device is defined as forward, and positions the lens system

and the image pickup device side by side so that the optical axis direction of the lens system is in parallel or almost parallel to the imaging surface of the image pickup device while deviating the optical axis of the lens system and the center of the imaging surface of the image pickup device from each other, and when the camera takes an image, rotates and moves the lens system so that the optical axis of the lens system becomes perpendicular to the imaging surface of the image pickup device and matches the optical axis of the lens system with the center of the imaging surface of the image pickup device.

[Claim 6] An electronic still camera which obtains an image by imaging a subject, wherein the electronic still camera comprises: a lens system; an image pickup device; a rotating mechanism which holds the lens system outside the rotation axis, and positions the lens system and the image pickup device side by side while deviating the optical axis of the lens system and the center of the imaging surface of the image pickup device from each other when the camera does not take an image, and rotates and moves while holding the lens system to match the optical axis of the lens system with the center of the imaging surface of the image pickup device when the camera takes an image; and a mechanical means which positions the lens system

so that the rear end of the lens system becomes further rearward than the image pickup device or a substrate that holds the image pickup device when the camera does not take an image and the direction toward the subject with respect to the imaging surface of the image pickup device is defined as forward, and moves the lens system in the normal line direction with respect to the lens surface in accordance with the rotation of the rotating mechanism when the camera takes an image.

[Claim 7] The electronic still camera according to any of Claims 1 through 6, wherein a mechanical power switch which turns the power source of the electronic still camera on or off is provided, and the lens system, the image pickup device, or the rotating mechanism that moves is arranged so that when it completes moving, the power switch is turned on.

[Claim 8] The electronic still camera according to any of Claims 1 through 6, wherein a mechanical power switch which turns the power source of the electronic still camera on or off is provided, and when the power switch is turned on, the lens system, the image pickup device, or the rotating mechanism that moves starts moving.

[DETAILED DESCRIPTION OF THE INVENTION]

[0001]

[Field of the Invention] The present invention relates to

downsizing and thinning of an electronic still camera.

[0002]

[Prior Art] In accordance with downsizing and simplification of the structures of image pickup devices and imaging lenses, various small-sized electronic still cameras have been provided, however, an imaging lens is disposed in front of the imaging surface of an image pickup device, so that the size of the forward side of a camera main body increases to an extent according to at least the imaging lens. As prior arts, Fig. 32 is a schematic explanatory view of a conventional electronic still camera, and in this figure, the reference numeral 70 denotes a telescopic imaging lens, and the reference numeral 71 denotes an imaging means including an image pickup device and a peripheral IC mounted on a substrate. As shown in this figure, the telescopic imaging lens 71 is employed to reduce the size and thickness of an electronic still camera by retracting the imaging lens 71 when it does not take an image.

[0003] Also, Fig. 33, Fig. 34, and Fig. 35 are drawings schematically showing a construction of an electronic still camera described in, for example, Japanese Patent Publication No. Hei-05-110920. In Fig. 33, the reference numerals 80 and 81 denote lenses, the reference numeral 82 denotes an imaging means formed by mounting an image pickup device and a peripheral

IC on a substrate, the reference numerals 83, 84, 85, 86, and 87 denote antidust shutters, and the reference numerals 89 and 90 denote joints. The electronic still camera is structured as shown in Fig. 31 by joining three blocks by joints 89 and 90, and an image of light via the lenses 80 and 81 is formed on the imaging surface of the image pickup device mounted on the imaging means 82. Fig. 35 is a birds-eye view of the electronic still camera shown in Fig. 33. As shown in Fig. 35, the three blocks are stacked together when the camera takes an image, and when the camera does not take an image, as shown in Fig. 34, the three blocks are made flat so that they become thin when they are carried or stored.

[0004]

[Problems to be Solved by the Invention] Since the conventional electronic cameras are constructed so as to employ a telescopic imaging lens, construction of the imaging lens is complicated and the thickness of the imaging lens has a limitation in downsizing so that the thickness of the electronic still camera is restricted by the number of lenses used inside the imaging lens, and therefore, thinning to more than certain extent becomes disadvantageous.

[0005] Furthermore, in the case of the construction of the electronic still camera shown in Fig. 33, the optical axis

easily deviates unless joints joining the three separate blocks to each other are securely and accurately constructed.

[0006] Furthermore, in the case of the construction of the electronic still camera shown in Fig. 33, two blocks of the three blocks include only lens portions, and dead spaces are created around the lenses or the portions where joints must be secured, and these are disadvantageous in downsizing.

[0007] The present invention was made to solve the abovementioned problems, and an object thereof is to provide a small-sized thin electronic still camera by a simple construction.

[0008]

[Means for Solving the Problems] In an electronic still camera relating to the invention, when the camera does not take an image, the optical axis of a lens system and the center of the imaging surface of an image pickup device are deviated from each other, and the lens system and the image pickup device are disposed side by side, and when the camera takes an image, the image pickup device or the lens system is moved to match the optical axis of the lens system with the center of the imaging surface of the image pickup device.

[0009] Furthermore, the lens system is disposed so that its rear end is positioned further rearward than the image pickup

device or a substrate that holds the image pickup device when the camera does not take an image, and when the camera takes an image, the image pickup device and the lens system are moved.

[0010] Or, the lens system is disposed so that its rear end is positioned further rearward than the image pickup device or a substrate that holds the image pickup device when the camera does not take an image, and when the camera takes an image, the lens system is moved forward of the imaging surface of the image pickup device.

[0011] Or, when the camera does not take an image, the lens system is laid on its side and disposed so as to be further rearward than the image pickup device or a substrate that holds the image pickup device, and the lens system is rotated and moved when the camera takes an image.

[0012] Or, a plurality of lens systems are provided so that the rear ends thereof are positioned further rearward than the image pickup device or a substrate that holds the image pickup device when the camera does not take an image, and any one of the lens systems is moved forward of the imaging surface of the image pickup device when the camera takes an image.

[0013] Or, a lens system is disposed so that its rear end is positioned further rearward than the image pickup device or the substrate that holds the image pickup device, and when the

camera takes an image, the lens system is rotated and moved by a rotating mechanism.

[0014] Furthermore, the power source of the electronic still camera is turned on when the means described in Claim 1 through Claim 6 is applied.

[0015] Furthermore, when the power source of the electronic still camera is turned on, the means of Claims 1 through 6 is applied.

[0016]

[Embodiments of the Invention] Hereinafter, embodiments of the invention are described in detail with reference to the drawings.

Embodiment 1. Fig. 1 shows a construction of an electronic still camera as embodiment 1 of the invention when the camera does not take an image, and Fig. 2 shows a construction of the electronic still camera of Embodiment 1 of the invention when it takes an image. In these figures, the reference numeral 1 denotes an imaging lens comprising a plurality of lenses, the reference numeral 2 denotes a mechanical means, the reference numeral 3 denotes an imaging means including an image pickup device mounted on a substrate, and the reference numeral 5 denotes a casing of the electronic still camera. Operations of the electronic still camera constructed as mentioned above

are described.

[0017] When the camera does not take an image, as shown in Fig. 1, the imaging lens 1 and the imaging means 3 are arranged side by side. The mechanical means 2 holds the imaging lens 1 or the imaging means 3, or both the imaging lens 1 and the imaging means 3. The imaging means 3 is formed by mounting an image pickup device for imaging a subject, an IC necessary for driving the image pickup device, and a signal processing circuit on a substrate. As mentioned above, the mechanical means 2 is arranged so that, when the camera does not take an image, the imaging lens 1 is housed in the casing 5, the imaging lens 1 is made parallel to the imaging means 3, and the rear end of the imaging lens 1 is positioned further rearward than the imaging means 3 (the rearward side of the electronic still camera in Fig. 1). In this invention, as shown in Fig. 1, with respect to the imaging surface of the imaging lens 1 and the image pickup device 3, the direction toward a subject is defined as "forward" (the forward direction shown in Fig. 1) of the electronic still camera, and the opposite direction is defined as "rearward" (the rearward direction shown in Fig. 1).

[0018] When the camera takes an image, as shown in Fig. 2, the mechanical means 2 moves the imaging lens 1 or the imaging means 3, or both the imaging lens 1 and the imaging means 3 to match

the optical axis of the imaging lens 1 with the center of the imaging surface of the image pickup device mounted on the imaging means 3. With the abovementioned construction, when the camera does not take an image, the imaging lens 1 is housed by the side of the imaging means 2 so that the rear end of the imaging lens 1 comes to the rear or close to the rear of the design 5, so that the electronic still camera can be made thin.

[0019] Embodiment 2. Fig. 3 shows a construction of an electronic still camera of Embodiment 2 of the invention when the camera does not take an image, and Fig. 4 shows a construction of the electronic still camera of Embodiment 2 of the invention when the camera takes an image. In these figures, the reference numeral 1 denotes an imaging lens composed of a plurality of lenses, the reference numeral 3 denotes an imaging means including an image pickup device mounted on a substrate, the reference numeral 5 denotes a casing of the electronic still camera, the reference numeral 6 denotes a first mechanical means which moves the imaging lens, and the reference numeral 7 denotes a second mechanical means which moves the imaging means. Operations of the electronic still camera constructed as mentioned above are described.

[0020] When the camera does not take an image, as shown in Fig. 3, the imaging lens 1 and the imaging means 3 are arranged side

by side. The first mechanical means 6 is constructed so as to hold the imaging lens 1 and moves the imaging lens 1 in the normal line direction with respect to the lens surface. The imaging means 3 is formed by mounting an image pickup device, an IC necessary for driving the image pickup device, and a signal processing circuit on a substrate in the same manner as Embodiment 1. The second mechanical means 6 is constructed so as to be able to move the imaging means 3 horizontally to the imaging surface of the image pickup device. As mentioned above, the electronic still camera is arranged so that when the camera does not take an image, the imaging lens 1 is housed in the casing 5 and arranged in parallel to the imaging means 3, and the rear end of the imaging lens 1 is positioned further rearward than the imaging means 3 (at the rearward side of the electronic still camera in Fig. 3). In this invention, as shown in Fig. 1, with respect to the imaging surface of the imaging lens 1 and the image pickup device 3, the direction toward a subject is defined as "forward" (the forward direction shown in Fig. 3) of the electronic still camera, and the opposite direction is defined as "rearward" (the rearward direction shown in Fig. 3).

[0021] When the camera takes an image, as shown in Fig. 4, the imaging lens 1 is moved in the optical axis direction by the

first mechanical means 6 and projects outward from the casing 5, and the imaging means 3 is moved in parallel by the second mechanical means 7 to a space created below the imaging lens 1 due to the movement. As mentioned above, the imaging lens 1 and the imaging means 3 are moved by the first and second mechanical means 6 and 7 and the optical axis of the imaging lens 1 and the center of the imaging surface of the image pickup device mounted on the imaging means 3 are matched with each other, whereby imaging is carried out. With the construction mentioned above, when the camera does not take an image, the imaging lens 1 is housed by the side of the imaging means 2 to the rear or close to the rear of the design 5, so that the electronic still camera can be made thin.

[0022] Fig. 5 shows a construction of an electronic still camera of other example of Embodiment 2 of the invention when the camera does not take an image, and Fig. 6 shows a construction of the electronic still camera of said another example of Embodiment 2 of the invention when the camera takes an image. In these figures, the reference numeral 8 denotes a lens cap for protecting the imaging lens 1 from the outside. The lens cap 8 saves its place by sliding horizontally as shown in Fig. 6 when the camera takes an image and protects the imaging lens 1 when the camera does not takes an image.

[0023] Embodiment 3. Fig. 7 shows a construction of an electronic still camera of Embodiment 3 of the invention when the camera does not take an image, and Fig. 8 shows a construction of the electronic still camera of Embodiment 3 of the invention when the camera takes an image. In these figures, the imaging lens 1, the imaging means 3, and the casing 5 are the same as those in Embodiment 1. A mechanical means 10 moves the imaging lens. Operations of the electronic still camera constructed as mentioned above are described.

[0024] When the camera does not take an image, as shown in Fig. 7, the imaging lens 1 is housed within the casing 5, the imaging lens 1 and the imaging means 3 are arranged side by side, and the rear end of the imaging lens 1 is positioned further rearward than the imaging means 3 as in Embodiment 2.

[0025] When the camera takes an image, as shown in Fig. 8, the imaging lens 1 is moved forward of the imaging surface of the image pickup device of the imaging means 3 by the mechanical means 10 and projects outward from the casing 5. Due to the movement of the imaging lens 1, the optical axis of the imaging lens and the center of the imaging surface of the image pickup device mounted on the imaging means 3 are matched with each other, whereby imaging is carried out. With the abovementioned construction, when the camera does not take an image, the

imaging lens 1 is housed by the side of the imaging means 2 so that the rear end of the imaging lens 1 comes to the rear or close to the rear of the design 5, so that the electronic still camera can be made thin.

[0026] Embodiment 4. Fig. 9 shows a construction of an electronic still camera of Embodiment 3 of the invention when the camera does not take an image, Fig. 10 shows a construction of the electronic still camera of Embodiment 3 of the invention when the camera takes an image, and Fig. 11 shows a construction of the electronic still camera of Embodiment 3 of the invention when the camera does not takes an image. In these figures, the imaging means 3 and the casing 5 are as in Embodiment 2. The reference numeral 20 denotes a first imaging lens, the reference numeral 21 denotes a second imaging lens whose focal length is shorter than that of the first imaging lens, the reference numeral 22 denotes a first mechanical means which moves the first imaging lens, the reference numeral 23 denotes a second mechanical means which moves the second imaging lens 21, and the reference numeral 24 denotes a selection means for selecting either one of the two imaging lenses to be used when the camera takes an image. Operations of the electronic still camera constructed as mentioned above are described.

[0027] When the camera does not take an image, as shown in Fig.

9, the first imaging lens 20 and the second imaging lens 21 are housed within the casing 5, and the first imaging lens 20, the second imaging lens 21, and the imaging means 3 are arranged side by side as shown in Fig. 9. The rear end of the first imaging lens 20 and the rear end of the second imaging lens 21 are disposed further rearward than the imaging means 3, respectively. In this invention, as shown in Fig. 9, with respect to the imaging surface of the imaging lens 1 and the image pickup device 3, the direction toward a subject is defined as "forward" (the forward direction shown in Fig. 9) of the electronic still camera, and the opposite direction is defined as "rearward" (the rearward direction shown in Fig. 9).

[0028] When taking an image, in a case where a user wants to take a tele-side image, by selecting the first imaging lens 20 by the selection means 24, as shown in Fig. 10, the first imaging lens 20 is moved above the image pickup device of the imaging means 3 by the first mechanical means 22 and projects outward from the casing 5. Due to the movement of the first imaging lens 20, the optical axis of the first imaging lens 20 and the center of the imaging surface of the image pickup device mounted on the imaging means 3 are matched with each other, whereby imaging is carried out. On the other hand, when a user wants to take a wide-side image, by selecting the second

imaging lens 21 by the selection means 24, as shown in Fig. 11, the second imaging lens 21 is moved above the image pickup device of the imaging means 3 by the second mechanical means 23 and projects outward from the casing 5. Due to the movement of the second imaging lens 1, the optical axis of the second imaging lens 21 and the center of the imaging surface of the image pickup device mounted on the imaging means 3 are matched with each other, whereby imaging is carried out. With the construction as mentioned above, when the camera does not take an image, the first imaging lens 20 and the second imaging lens 21 are housed by the side of the imaging means 2 so that the rear ends of the first and second imaging lenses 20 and 21 come to the rear or close to the rear of the design 5, whereby the electronic still camera can be made thin.

[0029] In this embodiment, two imaging lenses having different focal lengths are used, however, the number of imaging lenses is not limited to 2, and the same effect can be obtained regardless of the number of imaging lenses as long as the number is plural and mechanical means for moving the imaging lenses are provided.

[0030] Embodiment 5. Fig. 12 shows a construction of an electronic still camera of Embodiment 5 of the invention which uses an imaging lens of a long focal length side when the camera

takes an image, and Fig. 13 shows a construction of the electronic still camera of Embodiment 5 of the invention which uses an imaging lens of a short focal length side when the camera takes an image. In these figures, the imaging means 3 and the casing 5 are as in Embodiment 2. The reference numeral 30 denotes an imaging lens, the reference numeral 31 denotes a mechanical means which rotates and moves the imaging lens 30, and the reference numeral 32 denotes a moving casing that slides to the left and right. Operations of the electronic still camera constructed as mentioned above are described.

[0031] When the camera does not take an image, the imaging lens 30 is housed within the casing 5, and as shown in Fig. 12, the optical axis of the imaging lens 30 and the imaging surface of the image pickup device are made almost parallel to each other, and the imaging lens 30 and the imaging means 3 are arranged side by side. The side surface of the imaging lens 30 is positioned further rearward than the imaging means 3 (the rear side of the casing 5 in Fig. 10).

[0032] When the camera takes an image, as shown in Fig. 13, the imaging lens 30 is rotated and moved above the imaging means 3 by the mechanical means 31 and projects outward from the casing 5. Furthermore, along with the rotating movement of the imaging lens 30, the moving casing 32 slides so that the imaging

lens can project outward from the casing 5. Due to the movement of the imaging lens 30, the optical axis of the imaging lens 30 and the center of the imaging surface of the image pickup device mounted on the imaging means 3 are matched, whereby imaging is carried out. With the abovementioned construction, when the camera does not take an image, the imaging lens 30 is housed by the side of the imaging means 2 in a condition where it is laid on its side so that the lens surface of the imaging lens 30 becomes perpendicular to the imaging surface of the image pickup device, and the side surface comes to the rear or close to the rear of the design 5, so that the electronic still camera can be made thin.

[0033] Embodiment 6. Fig. 14 shows a construction of an electronic still camera of Embodiment 6 of the invention when the camera does not take an image, Fig. 15 shows a construction of the electronic still camera of Embodiment 6 of the invention when the camera takes an image, and Fig. 16 shows birds-eye views showing the electronic still camera of Embodiment 6 of the invention when it takes an image and when it does not take an image. In these figures, the imaging means 3 and the casing 5 are as in Embodiment 2. The reference numeral 40 denotes an imaging lens, and the reference numeral 41 denotes a rotating mechanism which holds the imaging lens 40 and rotates

horizontally to the lens surface. Operations of the electronic still camera constructed as mentioned above are described.

[0034] When the camera does not take an image, the imaging lens 40 is housed within the casing 5, and as shown in Fig. 14, is arranged in parallel with the imaging means 3 by being held by the rotating mechanism 41. The rear end of the imaging lens 40 is positioned further rearward than the imaging means 3 (the rearward side of the design 5 shown in Fig. 12). In this invention, as shown in Fig. 14, with respect to the imaging surface of the imaging lens 40 and the image pickup device 3, the direction toward a subject is defined as "forward" (the forward direction shown in Fig. 14) of the electronic still camera, and the opposite direction is defined as "rearward" (the rearward direction shown in Fig. 14).

[0035] When the camera takes an image, as shown in Fig. 15, by rotating the rotating mechanism 41, the imaging lens 40 rotates together with the rotating mechanism and moves in the optical axis direction of the imaging lens 40. As shown in the birds-eye views of Fig. 16, the imaging lens 40 is rotated and moved above the image pickup device of the imaging means 3 by the rotating mechanism 41 and projects outward from the casing 5. Due to the movement of the imaging lens 30, the optical axis of the imaging lens 30 and the center of the imaging surface

of the image pickup device mounted on the imaging means 3 are matched with each other, whereby imaging is carried out. With the construction mentioned above, when the camera does not take an image, the imaging lens 40 is housed by the side of the imaging means 2 so that the rear end of the imaging lens 40 comes to the rear or close to the rear of the design 5, so that the electronic still camera can be made thin.

[0036] Embodiment 7. Fig. 17 through Fig. 26 show an electronic still camera of Embodiment 7 of the invention. In Fig. 17, Fig. 19, Fig. 21, Fig. 23, and Fig. 25, the reference numeral 50 denotes a mechanical power switch for turning the power source of the electronic still camera on/off. In Fig. 18, Fig. 20, Fig. 22, Fig. 24, and Fig. 26, the reference numeral 55 denotes an auxiliary power source provided separately from the main power source of the electronic still camera. Operations of the electronic still camera constructed as mentioned above are described.

[0037] Fig. 17 is a construction view of the electronic still camera obtained by providing a power switch on the electronic still camera shown in Embodiment 2 of the invention, and as shown in Embodiment 2, the imaging lens 1 and the imaging means 3 are moved when the camera takes an image to match the optical axis of the imaging lens 1 with the center of the imaging surface

of the image pickup device mounted on the imaging means 3. In this embodiment, the first mechanical means 6 and the second mechanical means 7 are constructed to make it possible for a user to manually move the imaging lens 1 and the imaging means 3. In taking an image, when a user moves the imaging lens 1 and the imaging means 3 by using the first and second mechanical means 6 and 7, the power switch 50 is mechanically turned on when either one of the imaging lens 1 or the imaging means 3 completes moving, and in response to turning-on of the power switch 50, the power source of the imaging means 3 is turned on, whereby the electronic still camera turns into an imaging-ready state. Furthermore, as shown in Fig. 18, it is also possible that the abovementioned movement is carried out not manually but by an auxiliary power source 55, and the power switch 50 is turned on when either one of the imaging lens 1 or the imaging means 3 completes moving. When the imaging lens 1 and the imaging means 3 are returned to the locations where they are positioned when the camera does not take an image, the power switch 50 is turned off to turn the power source of the electronic still camera off.

[0038] Fig. 19 is a construction view of an electronic still camera obtained by providing a power switch on the electronic still camera of Embodiment 3 of the invention, and as shown

in Embodiment 3, when the camera takes an image, the imaging lens 1 moves to match the optical axis of the imaging lens 1 with the center of the imaging surface of the image pickup device mounted on the imaging means 3. In this embodiment, the mechanical means 10 is constructed to make it possible for a user to manually move the imaging lens 1. When a user moves the imaging lens 1 by using the mechanical means 10 for taking an image, the power switch 50 is mechanically turned on when the imaging lens 1 completes moving, and in response to turning-on of the power switch 50, the power source of the imaging means 3 is turned on, whereby the electronic still camera turns into an imaging-ready state. Furthermore, it is also possible that, as shown in Fig. 20, the movement is carried out not manually but by an auxiliary power source 55 and the power switch 50 is mechanically turned on when the imaging lens 1 completes moving. When the imaging lens 1 is returned to the location where it is positioned when the camera does not take an image, the power switch 50 is turned off to turn the power source of the electronic still camera off.

[0039] Furthermore, Fig. 21 is a construction view of an electronic still camera obtained by providing a power switch on the electronic still camera shown in Embodiment 4 of the invention, and as shown in Embodiment 4, the first imaging lens

20 or the second imaging lens 21 is moved when taking an image to match the optical axis of the imaging lens with the center of the imaging surface of the image pickup device mounted on the imaging means 3. In this embodiment, the first mechanical means 22 and the second mechanical means 23 are constructed to make it possible for a user to manually move the first imaging lens 20 and the second imaging lens. When a user moves the imaging lens 1 by the first mechanical means 20 or moves the imaging lens 2 by the second mechanical means 21 for taking an image, the power switch 50 is mechanically turned on when the first imaging lens 20 or the second imaging lens 21 completes moving, and in response to turning-on of the power switch 50, the power source of the imaging means 3 is turned on, whereby the electronic still camera turns into an imaging-ready state. Furthermore, it is also possible that, as shown in Fig. 22, the movement is carried out not manually but by an auxiliary power source 55, and the power switch 50 is mechanically turned on when the first imaging lens 20 or the second imaging lens 21 completes moving. When the first imaging lens 20 and the second imaging means 21 are returned to the locations where they are positioned when the camera does not take an image, the power switch 50 is turned off to turn the power source of the electronic still camera off.

[0040] Fig. 23 is a construction view of an electronic still camera obtained by providing a power switch on the electronic still camera shown in Embodiment 5 of the invention, and as shown in Embodiment 5, the imaging lens 30 is rotated and moved when taking an image to match the optical axis of the imaging lens 30 with the center of the imaging surface of the image pickup device mounted on the imaging means 3. In this embodiment, the mechanical means 31 is constructed to make it possible for a user to manually rotate and move the imaging lens 30. When a user rotates and moves the imaging lens 30 by the mechanical means 31 when taking an image, the power switch 50 is mechanically turned on when the imaging lens 30 completes moving, and in response to turning-on of the power switch 50, the power source of the imaging means 3 is turned on, whereby the electronic still camera turns into an imaging-ready state. Furthermore, it is also possible that, as shown in Fig. 24, the movement is carried out not manually but by using an auxiliary power source 55, and the power switch 50 is mechanically turned on when the imaging lens 30 completes moving. When the imaging lens 30 is returned to the location where it is positioned when the camera does not take an image, the power switch 50 is turned off to turn the power source of the electronic still camera off.

[0041] Fig. 25 is a construction view of an electronic still camera obtained by providing a power switch on the electronic still camera shown in Embodiment 6 of the invention, and as shown in Embodiment 6, the imaging lens 40 is rotated and moved above the image pickup device on the imaging means 3 by the rotating mechanism 41 when taking an image, whereby the optical axis of the imaging lens 40 is matched with the center of the imaging surface of the image pickup device mounted on the imaging means 3. In this embodiment, the rotating mechanism 41 is constructed to make it possible for a user to manually rotate and move the imaging lens 40. When a user rotates and moves the imaging lens 40 by the rotating mechanism 41 for taking an image, the power switch 50 is mechanically turned on when either one of the imaging lens 40 or the rotating mechanism 41 completes moving, and in response to turning-on of the power switch 50, the power source of the imaging means 3 is turned on, whereby the electronic still camera turns into an imaging-ready state. Furthermore, it is also possible that, as shown in Fig. 26, the rotation and movement are carried out not manually but by an auxiliary power source 55, and the power switch 50 is turned on when either of the imaging lens 40 or the rotating mechanism 41 completes moving. When the imaging lens 40 and the rotating mechanism 41 are returned to the

locations where they are positioned when the camera does not take an image, the power switch 50 is turned off to turn the power source of the electronic still camera off.

[0042] As mentioned above, the power switch 50 is interlocked with the movement of the imaging lens 1, 20, 21, 30, or 40, the imaging means 3, or the rotating mechanism 41 shown in Embodiments 2 through 6, and the power source of the electronic still camera is turned on at the same time the abovementioned lens completes moving, whereby the electronic still camera can be easily handled without requiring both operation of the power switch 50 and movement of the imaging lens 1, 20, 21, 30, or 40, the imaging means 3, or the rotating mechanism 41 when the camera takes an image, and after taking an image, by only housing the imaging lens 1, 20, 21, 30, or 40 upon the abovementioned movement, the power source is turned off, so that the power source can be prevented from being left turned-on.

[0043] Embodiment 8. Fig. 27 through Fig. 31 show an electronic still camera of Embodiment 8 of the invention. In these figures, the reference numeral 60 denotes a power switch. Operations of the electronic still camera constructed as mentioned above are described.

[0044] Fig. 27 is a construction view of an electronic still

camera obtained by providing a power switch on the electronic still camera shown in Embodiment 2 of the invention, and is constructed so that, to take an image, a user turns the power switch 60 on. When the power switch 60 is turned on, the power switch 60 supplies power to the imaging means 3 and outputs a command to the first mechanical means 4 and the second mechanical means 6 to start moving the imaging lens 1 and the imaging means 3. The first and second mechanical means 4 and 6 are moved, respectively, so that, as shown in Embodiment 2, the optical axis of the imaging lens 1 and the center of the imaging surface of the image pickup device mounted on the imaging means 3 are matched with each other. Therefore, only pressing the power switch 60 by a user turns the power source of the electronic still camera on, moves the imaging lens 1 and the imaging means 3 and turns the electronic still camera into an imaging-ready state. When the power switch 60 is pressed and the power source of the electronic still camera is turned off, the power switch 60 supplies a command to the first and second mechanical means 4 and 6, and turns the power source of the electronic still camera off after housing the imaging lens 1 and the imaging means 3 to the locations where they are positioned when the camera does not take an image.

[0045] Fig. 28 is a construction view of an electronic still

camera obtained by providing a power switch on the electronic still camera shown in Embodiment 3, and this embodiment is constructed so that a user takes an image by turning the power switch 60 on. When the power switch 60 is turned on, the power switch 60 turns the power source of the imaging means 3 on, and outputs a command to the mechanical means 10 to start moving the imaging lens 1. The mechanical means 10 moves, as shown in Embodiment 3, the imaging lens 1 so that the optical axis of the imaging lens 1 and the center of the imaging surface of the image pickup device mounted on the imaging means 3 are matched with each other. Therefore, only pressing the power switch 60 by a user turns the power source of the electronic still camera on, moves the imaging lens 1, and turns the electronic still camera into an imaging-ready state. When the power switch 60 is pressed to turn the power source of the electronic still camera off, the power switch 60 supplies a command to the mechanical means 10, and after the imaging lens 1 is housed to the location where the lens is positioned when the camera does not take an image, the power source of the electronic still camera is turned off.

[0046] Furthermore, Fig. 29 is a construction view of an electronic still camera obtained by providing a power switch on the electronic still camera shown in Embodiment 4 of the

invention, and in the construction of this embodiment, a user takes an image by turning the power switch 60 on. When the power switch 60 is turned on, the power switch 60 turns the power source of the imaging means 3 on, and outputs a command to the first mechanical means 22 to start moving the first imaging lens 20 or to the second mechanical means 23 to move the second imaging lens 21. The mechanical means 10 is moved, as shown in Embodiment 3, to match the optical axis of the first or second imaging lens 22 or 23 with the center of the imaging surface of the image pickup device mounted on the imaging means 3. Therefore, only pressing the power switch 60 by a user turns the power source of the electronic still camera on, moves the first imaging lens 20 or the second imaging lens 21, and turns the electronic still camera into an imaging-ready state. Furthermore, when the power switch 60 is pressed to turn the power source of the electronic still camera off, the power switch 60 supplies a command to the first and second mechanical means 22 and 23 to house the first imaging lens 20 and the second imaging lens 21 to the locations where they are positioned when the camera does not take an image, and thereafter, the power source of the electronic still camera is turned off.

[0047] Furthermore, Fig. 30 is a construction view of an electronic still camera obtained by providing a power switch

on the electronic still camera shown in Embodiment 5 of the invention, and in the construction of this embodiment, a user takes an image by turning the power switch 60 on. When the power switch 60 is turned on, the power switch 60 turns the power source of the imaging means 3 on, and outputs a command to the mechanical means 31 to start moving the imaging lens 30. The mechanical means 10 moves, as shown in Embodiment 5, the imaging lens 30 so as to match the optical axis of the imaging lens 30 with the center of the imaging surface of the image pickup device mounted on the imaging means 3. Therefore, only pressing the power switch 60 by a user turns the power source of the electronic still camera on, moves the imaging lens 30, and turns the electronic still camera into an imaging-ready state. When the power switch 60 is pressed to turn the power source of the electronic still camera off, after the power switch 60 supplies a command to the mechanical means 31 and houses the imaging lens 30 to the location where the lens is positioned when the camera does not take an image, the power source of the electronic still camera is turned off.

[0048] Furthermore, Fig. 31 is a construction view of an electronic still camera obtained by providing a power switch on the electronic still camera shown in Embodiment 6 of the invention, and in the construction of this embodiment, a user

takes an image by turning the power switch 60 on. When the power switch 60 is turned on, the power switch 60 turns the power source of the imaging means 3 on, and outputs a command to the rotating mechanism 41 to start moving the imaging lens 40. The rotating mechanism 41 moves the imaging lens 40 so as to match the optical axis of the imaging lens 40 with the center of the imaging surface of the image pickup device mounted on the imaging means 3 as shown in Embodiment 6. Therefore, only pressing the power switch 60 by a user turns the power source of the electronic still camera on, moves the imaging lens 40, and turns the electronic still camera into an imaging-ready state. When the power switch 60 is pressed to turn the power source of the electronic still camera off, the power switch 60 sends a command to the rotating mechanism 41 and houses the imaging lens 40 to the location where the lens is positioned when the camera does not take an image, and thereafter, the power source of the electronic still camera is turned off.

[0049] As described above, when the power switch 60 is turned on, the imaging lens 1, 20, 21, 30, or 40, or the imaging means 3 or the rotating mechanism 41 is moved by being interlocked with the power switch, whereby the electronic still camera can be easily handled without requiring both operation of the power switch 60 and movement of the imaging lens 1, 20, 21, 30, or

40, or the imaging means 3 or the rotating mechanism 41, and furthermore, after imaging is finished, by only pressing the power switch 60, the abovementioned imaging lens 1, 20, 21, 30, or 40 is simultaneously moved and housed.

[0050]

[Effects of the Invention] The invention has the following effects due to its construction as mentioned above.

[0051] By changing the arrangement of the imaging lens and the image pickup device between when the camera takes an image and when the camera does not take an image, a very thin electronic still camera can be obtained.

[0052] Furthermore, when the camera takes an image, the imaging lens is moved outward from the design and the image pickup device is moved behind the imaging lens, whereby a very thin electronic still camera can be obtained.

[0053] Furthermore, the imaging lens is housed within a casing of an electronic still camera when the camera does not take an image, whereby a very thin electronic still camera can be realized by a simple construction.

[0054] Furthermore, a plurality of imaging lenses whose focal lengths are different can be used, and a very thin electronic still camera can be obtained.

[0055] Furthermore, even when an imaging lens such as a

long-focal lens whose diameter is shorter than its length in the optical axis direction is used, a very thin electronic still camera can be obtained.

[0056] Furthermore, a very thin electronic still camera can be obtained.

[0057] Furthermore, electronic still cameras shown in Claims 1 through 5 that are thin and can be easily handled can be obtained.

[BRIEF DESCRIPTION OF THE DRAWINGS]

[Fig. 1] A drawing showing the construction of the electronic still camera of Embodiment 1 of the invention when the camera does not take an image.

[Fig. 2] A drawing showing the construction of the electronic still camera of Embodiment 1 of the invention when the camera takes an image.

[Fig. 3] A drawing showing the construction of the electronic still camera of Embodiment 2 of the invention when the camera does not take an image.

[Fig. 4] A drawing showing the construction of the electronic still camera of Embodiment 2 of the invention when the camera takes an image.

[Fig. 5] A drawing showing the construction of another example of the electronic still camera of Embodiment 2 of the invention

when the camera does not take an image.

[Fig. 6] A drawing showing the construction of another example of the electronic still camera of Embodiment 2 of the invention when the camera takes an image.

[Fig. 7] A drawing showing the construction of another example of the electronic still camera of Embodiment 3 of the invention when the camera does not take an image.

[Fig. 8] A drawing showing the construction of the electronic still camera of Embodiment 3 of the invention when the camera takes an image.

[Fig. 9] A drawing showing the construction of the electronic still camera of Embodiment 4 of the invention when the camera does not take an image.

[Fig. 10] A drawing showing the construction of the electronic still camera of Embodiment 4 of the invention when the camera takes an image.

[Fig. 11] A drawing showing the construction of the electronic still camera of Embodiment 4 of the invention when the camera does not take an image.

[Fig. 12] A drawing showing the construction of the electronic still camera of Embodiment 5 of the invention which uses an imaging lens of a long focal length side when the camera takes an image.

[Fig. 13] A drawing showing the construction of the electronic still camera of Embodiment 5 of the invention which uses an imaging lens of a short focal length side when the camera takes an image.

[Fig. 14] A drawing showing the construction of the electronic still camera of Embodiment 6 of the invention when the camera does not take an image.

[Fig. 15] A drawing showing the construction of the electronic still camera of Embodiment 6 of the invention when the camera takes an image.

[Fig. 16] Bird's-eye views of the electronic still camera of Embodiment 6 of the invention when the camera does not take an image and when the camera takes an image.

[Fig. 17] A construction view of an electronic still camera obtained by providing a power switch on the electronic still camera shown in Embodiment 2 of the invention.

[Fig. 18] A construction view of an electronic still camera obtained by providing a power switch and an auxiliary power source on the electronic still camera shown in Embodiment 2 of the invention.

[Fig. 19] A construction view of an electronic still camera obtained by providing a power switch on the electronic still camera shown in Embodiment 3 of the invention.

[Fig. 20] A construction view of an electronic still camera obtained by providing a power switch and an auxiliary power source on the electronic still camera shown in Embodiment 3 of the invention.

[Fig. 21] A construction view of an electronic still camera obtained by providing a power switch on the electronic still camera shown in Embodiment 4 of the invention.

[Fig. 22] A construction view of an electronic still camera obtained by providing a power switch and an auxiliary power source on the electronic still camera shown in Embodiment 4 of the invention.

[Fig. 23] A construction view of an electronic still camera obtained by providing a power switch on the electronic still camera shown in Embodiment 5 of the invention.

[Fig. 24] A construction view of an electronic still camera obtained by providing a power switch and an auxiliary power source on the electronic still camera shown in Embodiment 5 of the invention.

[Fig. 25] A construction view of an electronic still camera obtained by providing a power switch on the electronic still camera shown in Embodiment 6 of the invention.

[Fig. 26] A construction view of an electronic still camera obtained by providing a power switch and an auxiliary power

source on the electronic still camera shown in Embodiment 6 of the invention.

[Fig. 27] A construction view of an electronic still camera obtained by providing a power switch on the electronic still camera shown in Embodiment 2 of the invention.

[Fig. 28] A construction view of an electronic still camera obtained by providing a power switch on the electronic still camera shown in Embodiment 3 of the invention.

[Fig. 29] A construction view of an electronic still camera obtained by providing a power switch on the electronic still camera shown in Embodiment 4 of the invention.

[Fig. 30] A construction view of an electronic still camera obtained by providing a power switch on the electronic still camera shown in Embodiment 5.

[Fig. 31] A construction view of an electronic still camera obtained by providing a power switch on the electronic still camera shown in Embodiment 6 of the invention.

[Fig. 32] A construction view of an electronic still camera according to a prior art.

[Fig. 33] A construction view of an electronic still camera according to a prior art when the camera does not take an image.

[Fig. 34] A construction view of the electronic still camera according to the prior art when the camera takes an image.

[Fig. 35] A birds-eye view of the electronic still camera shown in Fig. 33.

[Description of Symbols]

1, 30, 40, 70: imaging lens, 2, 10, 31: mechanical means, 3, 71, 82: imaging means, 5: casing, 6, 22: first mechanical means, 7, 23: second mechanical means, 8: lens cap, 20: first imaging lens, 21: second imaging lens, 24: selection means, 32: moving casing, 41: rotating mechanism, 50, 60: power switch, 55: auxiliary power source, 80, 81: lens, 83, 84, 85, 86, 87: antidust shutter, 89, 90: joint

[Fig. 1], [Fig. 3], [Fig. 4], [Fig. 9], [Fig. 12], [Fig. 14]

Forward

Rearward

[Fig. 2]

Optical axis

Fig. 1

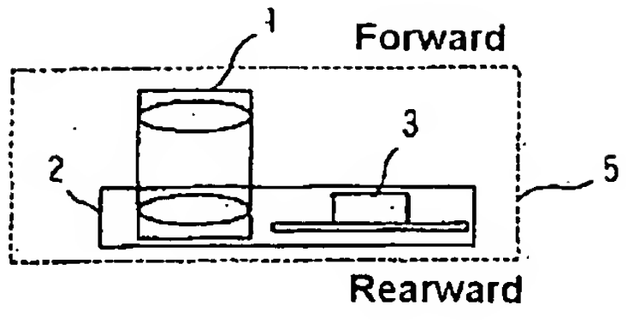


Fig. 2

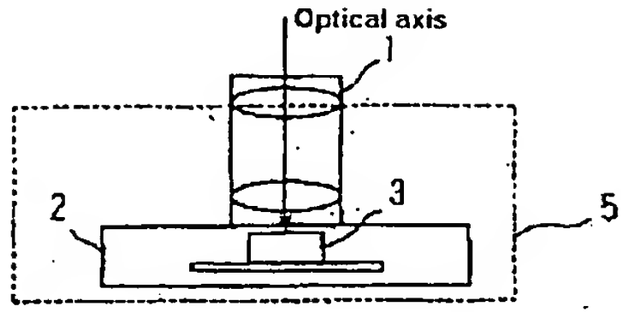


Fig. 3

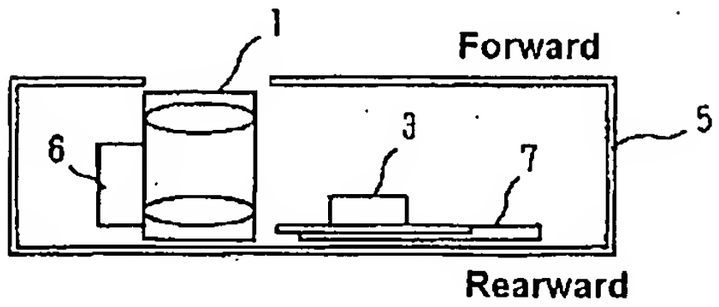


Fig. 4

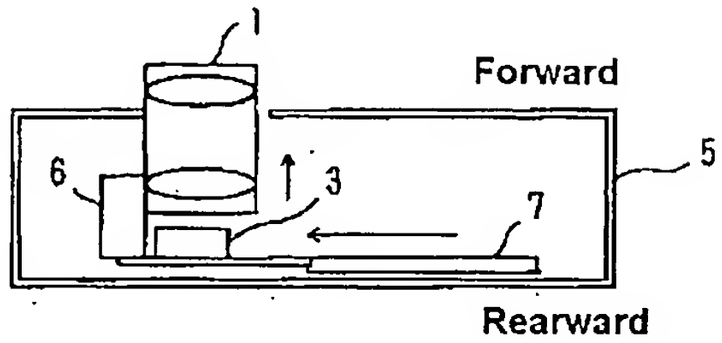


Fig.5

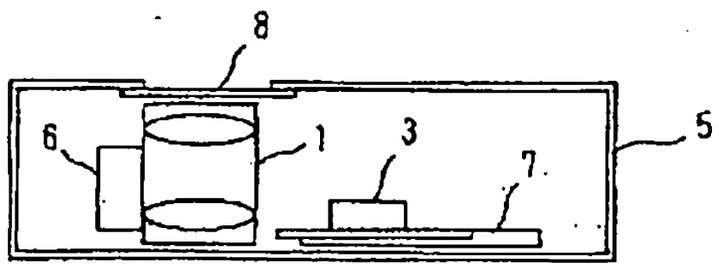


Fig.6

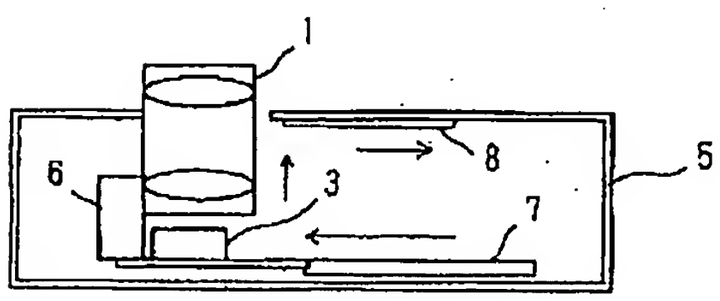


Fig.7

Fig.8

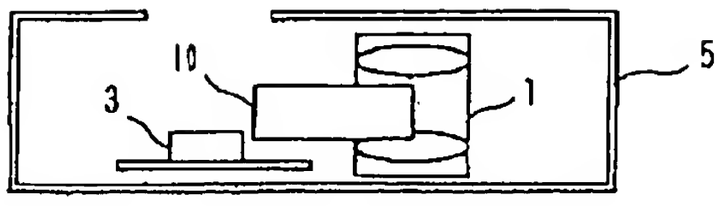


Fig. 9

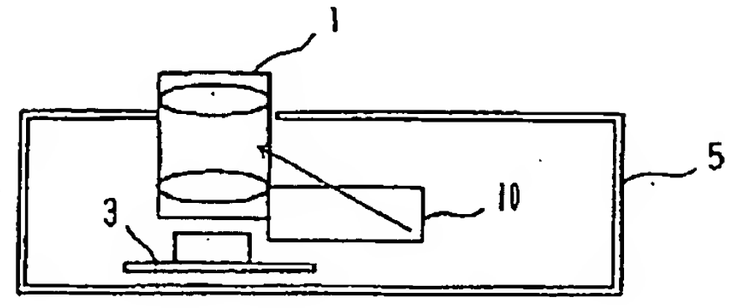


Fig.10

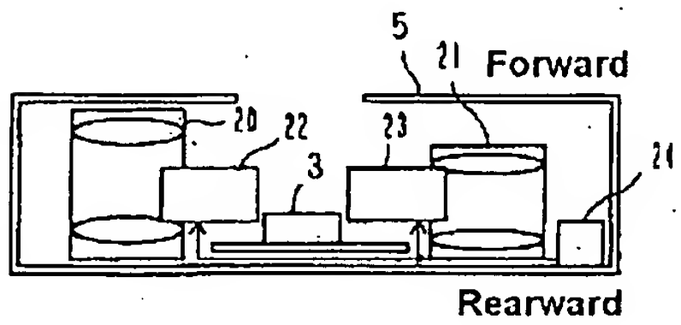


Fig.11

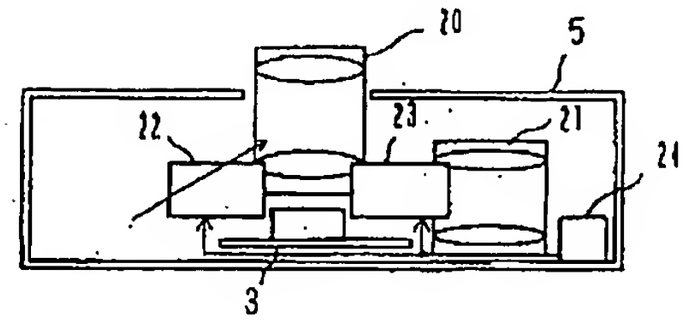


Fig. 12

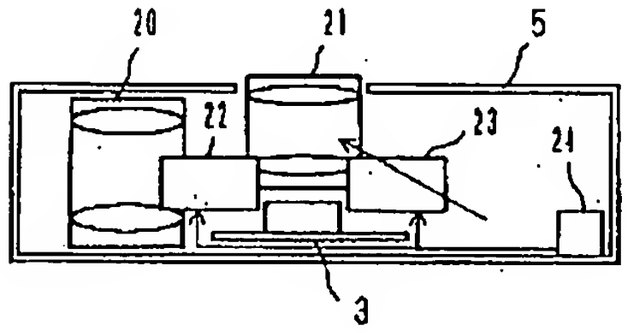


Fig.13

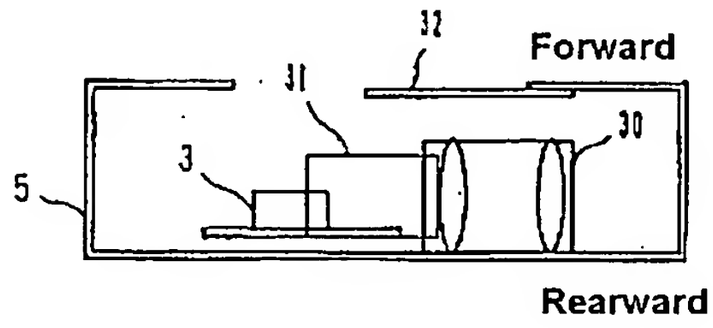
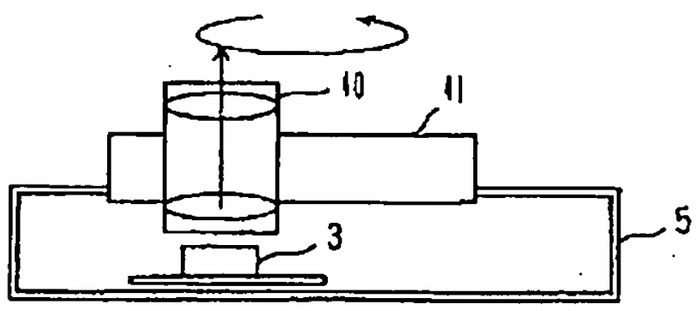


Fig.14

Fig.15

Fig.16



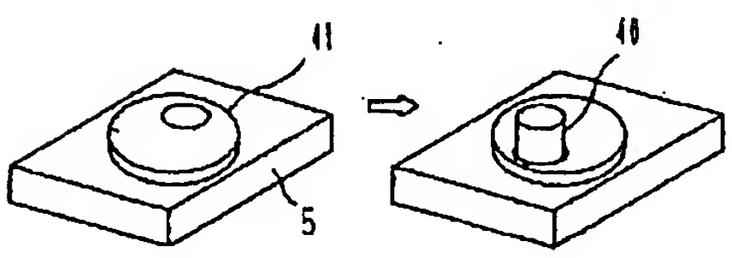


Fig.17

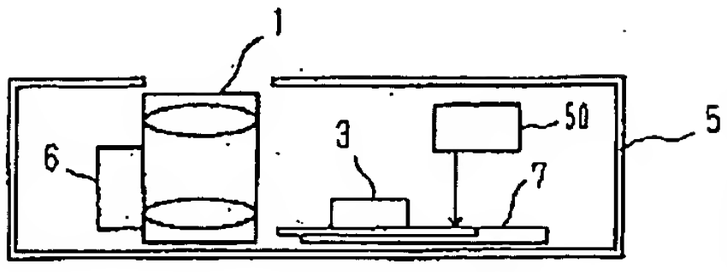


Fig.18

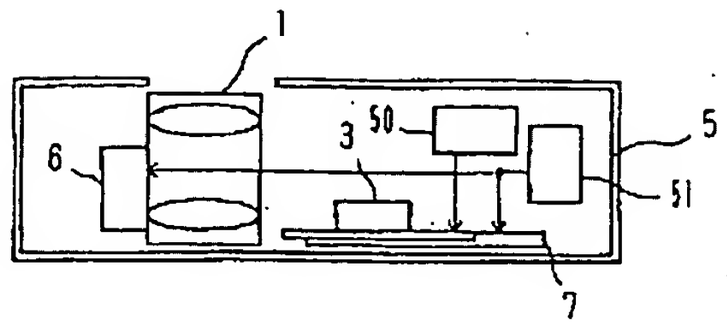


Fig.35

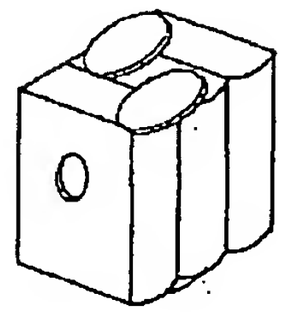


Fig.19

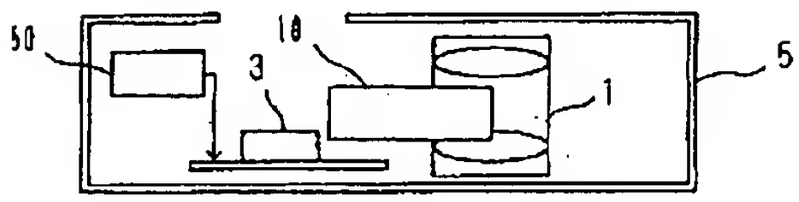


Fig.20

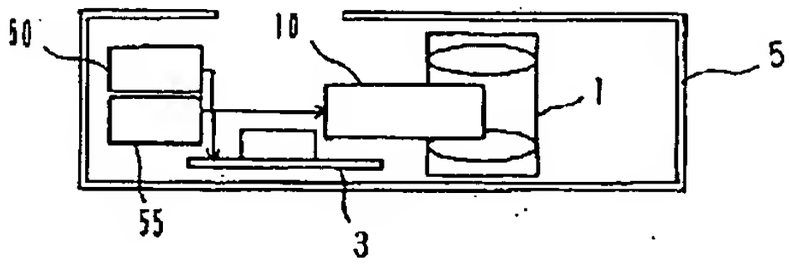
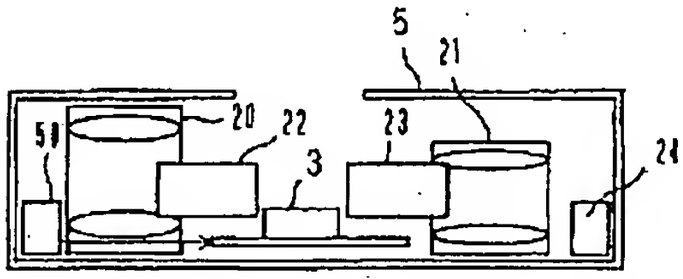
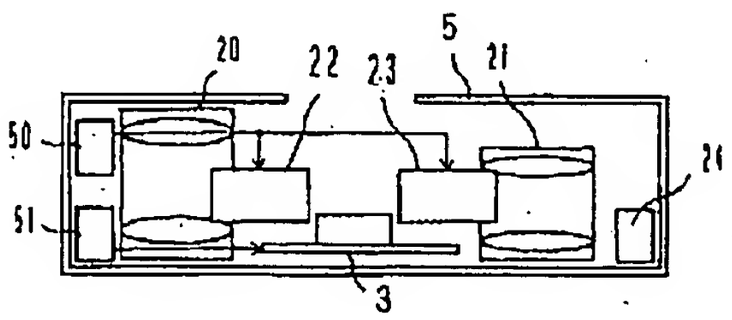


Fig.21

Fig.22

Fig.34





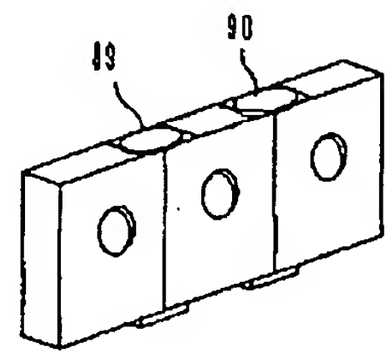
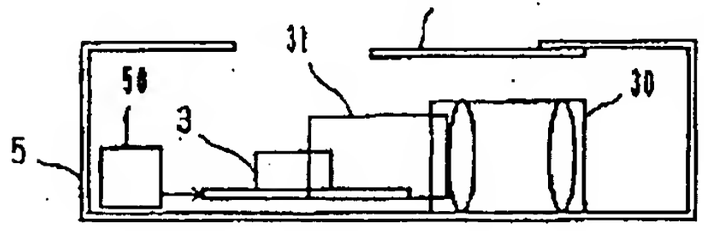


Fig.23

Fig.24



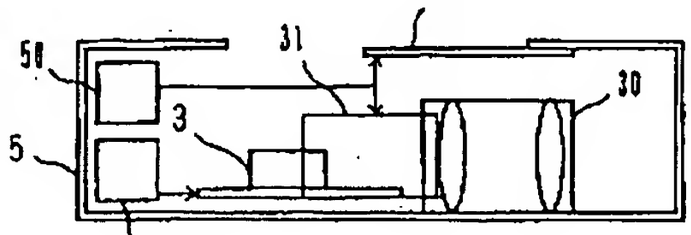
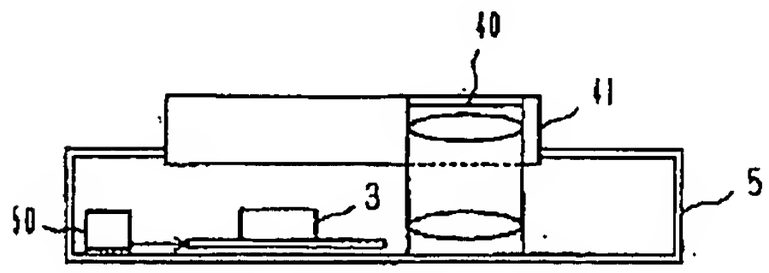


Fig.25

Fig.26



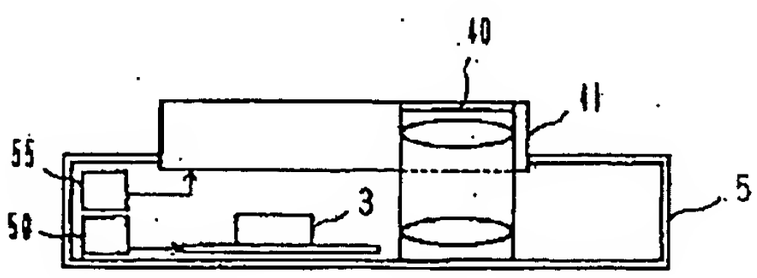


Fig.27

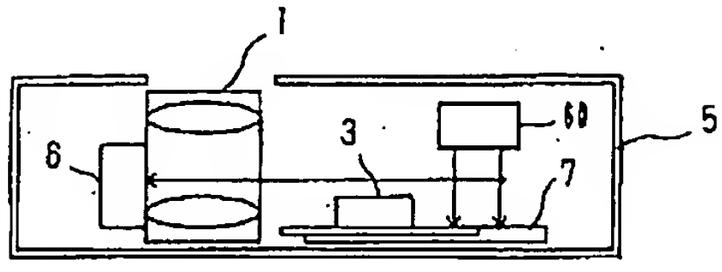


Fig.29

Fig.28

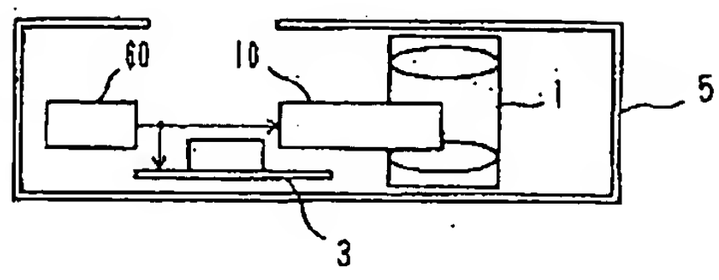


Fig.30

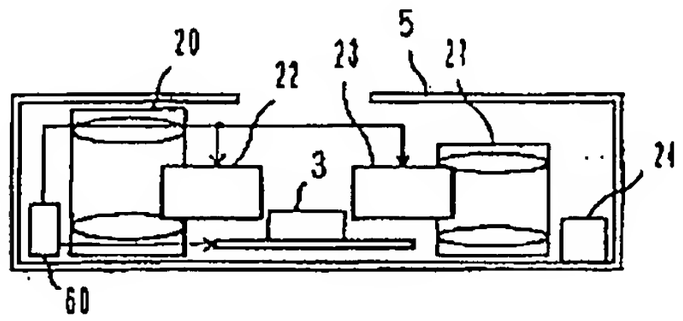


Fig.31

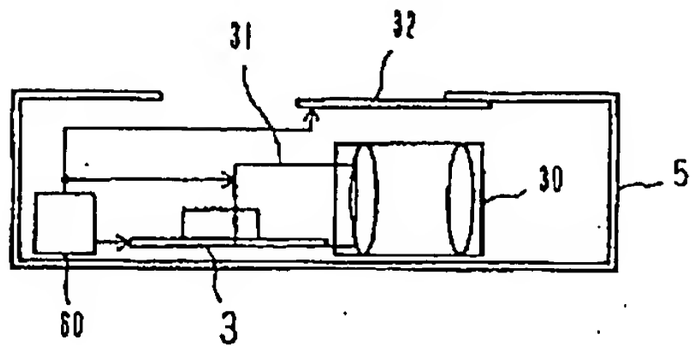


Fig.32

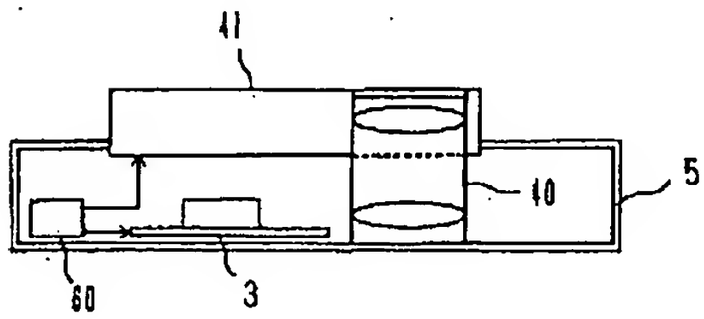


Fig.33